662.17-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
662002-*	GALVANIZED STEEL CONDUIT	LUMP SUM
662003-*	POLYVINYLCHLORIDE CONDUIT	LUMP SUM
662006-*	JUNCTION BOX , TYPE “type”	EACH
662007-*	LUMINAIRES	EACH
662008-*	CABLE	LUMP SUM
662010-*	LIGHTING SUPPORT, TYPE “type”	LUMP SUM
662013-*	SERVICE AND CONTROL STATION	LUMP SUM
662014-*	INCIDENTAL ELECTRICAL WORK	LUMP SUM
662015-*	ELECTRICAL TEST	LUMP SUM
662016-*	SYSTEM MODIFICATION	LUMP SUM
662020-*	NAVIGATION LIGHTING SYSTEM	LUMP SUM

*Sequence Number

SECTION 663
PAVEMENT MARKINGS

663.1-DESCRIPTION:

Pavement markings shall consist of furnishing and installing various types of markings. It shall include, but is not limited to, edge lines, lane lines, barrier lines, channelizing lines, stop and crosswalk lines, stripes, curb marking, island marking, lane arrows, lane letters and raised markers, or combinations thereof, in accordance with Contract plans and the following specifications or as directed by the Engineer.

All details not specified or not shown on the Plans shall conform to the details and requirements set forth in the following publication:

The Manual on Uniform Traffic Control Devices for Streets and Highways, latest issue, as printed by the Federal Highway Administration, U.S. Department of Transportation. (Referred to as the MUTCD.)

663.2-MATERIALS:

Materials shall conform to the following Subsections of Division 700 of the Standard Specifications:

MATERIAL	SUBSECTION
White or Yellow Fast-Dry Traffic Zone Paint	711.41
Pavement Marking Material	711.40
Extruded Thermoplastic Pavement Marking Material	715.40.1
Preformed Traffic Markings	715.40.2
Temporary Pavement Markings	715.40.4
Raised Markers	715.40.6

663.3-TYPES OF PAVEMENT MARKINGS:

663.3.1-Edge Lines: Edge lines shall be continuous, broken or dotted white beaded stripes or continuous yellow beaded stripes, 4 inches (100 mm) in width, or as specified on the Plans. Color to be specified on Plans. Center of stripe shall be located 6 inches (150 mm) from the edge of the pavement or as specified on the Plans.

Broken edge lines shall be white beaded stripes applied in lengths of 10 ft. (3 m), separated by gaps of 30 feet (9 m).

Dotted edge lines shall be white beaded stripes, applied in lengths of 2 feet (0.6 m), separated by gaps of 13 feet (4 m).

663.3.2-Lane Lines and Centerline: Lane lines and centerlines shall be lines between contiguous lanes of pavement. They shall be white or yellow, beaded stripes, applied in lengths of 10 feet (3 m), separated by gaps of 30 feet (9 m). Where applied to bituminous surfaces, the center of the stripes shall be located exactly half way between the centers of contiguous lanes. Where applied to portland cement concrete pavement, the center of the stripe shall be offset to the left and 4 inches (100 mm) from the longitudinal joint.

663.3.3-Barrier Lines: Barrier lines shall be continuous yellow beaded stripes, 4 inches (100 mm) in width. Barrier lines shall be located as shown on the Plans.

663.3.4-Channelizing Lines: Channelizing lines shall be continuous white beaded stripes. The width of line and use shall be as detailed on the Plans.

663.3.5-Stop and Crosswalk Lines: Stop lines shall be solid white beaded lines, not less than 12 in. (300 mm) nor more then 24 in. (600 mm) wide, or as specified on the Plans. Crosswalk lines shall be solid white beaded lines, not less than 6 inches (150 mm) nor more than 12 in. (300 mm) wide.

663.3.6-Stripes: These markings are transverse, diagonal or longitudinal white or yellow beaded lines 12 in. (300 mm) to 24 in. (600 mm) wide. They are used to increase the visibility of pedestrian crosswalk areas and to designate

neutral traffic zones formed by channelizing lines or edge lines. Location, spacing and use of these stripes shall be shown on the Plans.

663.3.7-Curb and Island Markings: Where specified, exposed surfaces of curbs and paved islands shall be prepared in accordance with 663.4 and painted solid with yellow or white traffic zone paint and covered with glass beads. Color to be specified on the Plans.

663.3.8-Lane Arrows: Lane arrows shall be white beaded markings located and dimensioned as shown on the Plans.

663.3.9-Lane Letters: Lane letters shall be white beaded markings located and dimensioned as shown on the Plans.

663.3.10-Raised Pavement Markers: Raised pavement markers are button or other type reflective or nonreflective raised markings. Type and installation are as shown on the Plans.

CONSTRUCTION METHODS

663.4-PAVEMENT PREPARATION - PREMARKING, CODING:

The Contractor shall clean all debris from the surface to be marked by means of a power broom, compressed air or other mechanical means to the satisfaction of the Engineer. Markings and markers shall be applied only when the surface is clean and dry and when the ambient air temperature is 50° F (10° C) or above, unless otherwise stated in the material specification.

If pavement markings are included in the contract, they shall be applied in a timely manner and in the patterns directed by the MUTCD.

When portland cement concrete is to be painted with Type I or Type Il traffic zone paint and it is called for on the Plans, the area to be painted shall be treated when dry, prior to painting, with a solution composed of one part by volume of concentrated (75 percent) phosphoric acid mixed with 22 parts by volume of water. The rate of application shall be 10 gal.per mile (km) of 4 in. (38 liters per km of 100 mm) stripe or one gallon per 20 sq. yd. (0.25 liters per square meter) of surface. Acid pretreatment shall be allowed to dry for at least one hour prior to the application of paint.

When using extruded or hot-sprayed thermoplastic material or prefabricated temporary pavement markings, primer (sealer) shall be applied in front of the applicator. The primer (sealer) shall be of the type and be applied at the rate as recommended by the manufacturer of the material.

All surface cleaning, surface pre-treatment and premarking shall be performed by the Contractor prior to the installation of the proposed markings, or markers, and shall be subject to approval by the Engineer.

Coding and premarking changes in traffic flow patterns, i.e., passing, no-passing zones, is very critical and should always be approved by the Engineer.

663.5-APPLICATION:

663.5.1-General: The Contractor shall supply devices, suitable to the Engineer, to measure thickness of the applied markings.

The Contractor shall supply all of the marking material, necessary auxiliary vehicles and traffic control devices required for the completion of the project.

The Contractor shall provide and have approved by the Division a plan for traffic control and maintenance for all phases of the marking operations. The plan must be approved by the Division prior to the beginning of work. All traffic control plans shall be in conformance with provisions in the standard, "Traffic Control for Street and Highway Construction and Maintenance Operations," published by the Division.

663.5.3 -Blank

663.5.4-Extruded Thermoplastic Pavement Markings: Extruded thermoplastic pavement markings shall have a uniform thickness throughout their lengths and widths. Unless otherwise specified in the Plans, the minimum thickness of the markings applied by extrusion shall not be less than 90 mils (2.3 mm) in the center of the marking and 60 mils (1.5 mm) at one half inch (13 mm) from the edge. Maximum thickness shall be 125 mils (3.2 mm).

663.5.5-Preformed Traffic Markings: Preformed traffic markings shall be fabricated to a uniform thickness of not less than that tested in the Division's field evaluation test. The markings shall be capable of being affixed to bituminous or portland cement concrete pavements as recommended by the manufacturer.

663.5.6-Blank:

663.5.7 Temporary Pavement Markings: Type VIIA Temporary Pavement Markings shall be prefabricated to a uniform thickness of not less than 20 mils (0.5 mm) nor more than 45 mils (1.1 mm). The marking shall be capable of being affixed to bituminous or portland cement concrete pavement by a pressure-sensitive precoated adhesive and require no activation. The marking material shall be flexible, formable and following application shall remain conformed to the texture of the pavement surface.

Type VIIB Temporary Pavement Markings shall be installed in accordance with manufacturer's recommendations. The pavement surface shall be dry at the time of pavement marking application. The Contractor shall remove all dirt, debris, loose particles and heavy oil residues from road surface application areas immediately prior to installation of pavement markings.

Type VIIB temporary pavement marking film shall be applied with a mechanical applicator to provide pavement lines which are neat, accurate and uniform. The mechanical applicator shall be equipped with a film cut-off

device. The pavement marking film shall be rolled or tamped to facilitate adhesion to road surface.

All temporary pavement markings shall present a uniform appearance and shall be clearly visible during the day and night for traffic control. Pavement markings which either fail to adhere to the pavement, provide a uniform appearance or be clearly visible during day or night shall be corrected by the Contractor in a manner acceptable to the Engineer at no additional cost to the Division.

When temporary pavement markings are no longer required as approved or determined by the Engineer, the plastic pavement marking film shall be neatly removed in its entirety.

Temporary pavement markings shall be Type VIIB.

663.5.8-Blank

663.5.9-Raised Markers: Raised markers shall be installed as specified in the Plans. The adhesive used for the installation of the markers shall be that which is furnished or recommended by the manufacturer of the marker. The adhesive shall be blended and used only as recommended by the manufacturer of the adhesive.

The adhesive shall be mechanically mixed and placed on any job requiring 50 or more markers.

663.5.10-Glass Beads: Glass beads applied to the surface of the completed marking material shall be applied by an automatic bead dispenser attached to the pavement marking equipment in such a manner that the beads are dispensed uniformly and almost instantly upon the marking as the marking is being applied to the road surface. The bead dispenser shall be equipped with an automatic cut-off control, synchronized with the cut-off of the pavement marking equipment.

Beads shall be dispensed at the following rate for types of material shown:

Marking Material	**Bead Application Rate**
Extruded Thermoplastic	05 kg/liter²

Glass beads shall be uniformly incorporated into the extruded thermoplastic pavement marking material at a rate of not less than 20% nor more than 35% by weight of the material.

663.6-METHOD OF MEASUREMENT:

Pavement markings shall be measured complete in place in the units designated below. Length measurements shall exclude gaps. Calibrated and verified odometer measurements will be acceptable as method of measurement on edge lines (mainline only), lane lines or centerlines and barrier lines for plan quantities in excess of 10,000 linear ft. (3 000 m) or two linear miles (3.2 km).

Island marking will be measured by the square foot (meter) of island area painted.

663.7-BASIS OF PAYMENT:

663.7.1-General: The quantities, determined as provided above, will be paid for at the contract unit prices less adjustments referred to below, which shall constitute full compensation for furnishing all materials and doing all the work prescribed in a workmanlike and acceptable manner, including the furnishing of all the auxiliary vehicles, labor, tools, equipment, supplies and incidentals necessary to complete the work.

The payment for Temporary Pavement Markings includes removal of the pavement marking film.

663.7.2-Price Adjustments: Price adjustments for deficiencies in pavement markings, exclusive of Type II or IX pavement markings, not within tolerances listed shall be as set forth:

i. Deficiencies: The amount of marking material or beads applied per unit of length shall be computed by the Engineer. If such computation reveals than an in sufficient quantity of either marking material or beads has been applied, the contract unit price shall be reduced in direct proportion to the percent of deficiency, up to 20 percent. However, if both beads marking material are deficient, only the greater deficiency be used to compute the deductions. If the deficiency is 20 percent, or more, the work shall be considered unsatisfactory and shall be redone at no additional cost to the Division.

ii. Tolerances: Any measurement given as length or width when referring to pavement marking lines or stripes shall have a tolerance of plus or minus 5 percent. This is to include any pattern of broken or dotted lines as well as spaces and gaps between markings. If, after sufficient sampling, the Engineer finds the installed markings not to be within the acceptable tolerance, either the work shall be considered unsatisfactory and shall be redone at no additional cost to the Division or, in case of an overage, no additional payment shall be made.

663.8

663.8-PAY ITEMS:

ITEM	DESCRIPTION	UNIT
663001-*	EDGE LINE, TYPE "type"	LINEAR MILE (KILOMETER) or FOOT (M)
663002-*	LANE LINE OR CENTERLINE, TYPE "type"	LINEAR MILE (KILOMETER) or FOOT (M)
663003-*	BARRIER LINE, TYPE "type"	LINEAR MILE (KILOMETER) or FOOT (M)
663005-*	STOP LINE, TYPE "type"	FOOT (M)
663006-*	CROSSWALK LINE, TYPE "type"	LINEAR FOOT (M)
663007-*	STRIPE, TYPE "type"	LINEAR FOOT (M)
663010-*	LANE ARROW, TYPE "type"	EACH
663011-*	LANE LETTER, TYPE "type"	EACH
663012-*	RAISED PAVEMENT MARKER, TYPE "type"	EACH

*Sequence Number

SECTION 664
TRAFFIC SAFETY DEVICES

664.1-DESCRIPTION:

This work shall consist of the furnishing and installing of various types of traffic safety devices in accordance with these Specifications and the Plans or as established by the Engineer. This work shall include, but not be limited to impact attenuating devices.

664.2-MATERIALS:

Materials shall conform to the requirements of the following subsections of Division 700 as manufactured by Energy Absorption Systems, Incorporated, or approved equal.

MATERIALS	SUBSECTION
Sand Barrel Impact Attenuating Device (Type V)	715.41.1
Crash Cushion Terminal Impact Attenuating Device (Type VI)	715.41.2
Truck Mounted Attenuating Devices (Type VII)	715.41.3
Quad Guard Terminal Device (Type VIII)	715.41.4